



**Allegato 2 – Piano formativo del Master di II livello
Master Internazionale in “CO2 Geological Storage”
Dipartimento Scienze della Terra, Facoltà di Scienze MM., FF., NN.**

Direttore del Master:	<i>Prof. E. Carminati</i>
Consiglio Didattico Scientifico	<i>Il consiglio Didattico scientifico include professori dalle Università Partner.</i> <ul style="list-style-type: none">- Prof. Eugenio Ambrogio Maria Carminati- Prof. Sabina Bigi- Prof. Michele Cercato- Prof. Paola Ballirano- Prof. Maurizio Battaglia- Prof. Bruno Saftic (Zagreb University)- Prof. Zelica Kurelec (Zagreb University)- Prof. D. Vulin (Zagreb University)- Prof. Iva K. Močilac-
Borse di studio o altre agevolazioni:	<i>non sono previste borse di studio</i>
Calendario didattico	<i>1 febbraio 2019 - 31 gennaio 2020 (il dettaglio allegato al presente documento)</i>
Pagina web del master	<i>Vedi allegato 3</i>
Lingua di erogazione	<i>Inglese</i>
Eventuali forme di didattica a distanza	<i>Non sono previste.</i>
Altre informazioni utili	<i>Questo Master è previsto nelle attività di ricerca e di disseminazione del Progetto europeo ENOS (Enhanced onshore carbon storage in Europe)(http://www.enos-project.eu/) per preparare una nuova generazione di giovani ricercatori e professionisti che vogliono lavorare su questi argomenti. Gli argomenti del corso includono una sintesi dei risultati della ricerca sul CCS e delle conoscenze acquisite dalle attività di stoccaggio in corso nei siti piloti europei e in quelli del progetto stesso, con particolare riguardo all'iniezione di CO₂ e alle tecniche di monitoraggio, all'esplorazione di processi critici negli studi in laboratorio e alla modellazione numerica.</i>



Piano delle Attività Formative del Master in: Master Internazionale in “CO₂ Geological Storage”

Denominazione attività formativa	Descrizione obiettivi formativi	Responsabile insegnamento	Settore scientifico disciplinare (SSD)	CFU	Ore	Tipologia	Verifiche di profitto
Module 1 - Introduction to CO₂ geological storage - Social aspect (Introduzione allo stoccaggio geologico del CO₂ – Aspetti sociali)	Modulo introduttivo che illustra in generale tutti gli aspetti legati allo stoccaggio geologico di CO ₂ , la necessità di adottare lo stoccaggio geologico nell’ambito della progettazione di un piano energetico nazionale e descrive l’impatto che lo stoccaggio geologico può potenzialmente avere sulla società e i cittadini.	Prof. S. Bigi Prof. E. Carminati	Geo/03	3	75	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto
Module 2 - CO₂ Capture and transport. Present day industrial utilization of CO₂ (La cattura e il trasporto di CO₂. Attuale utilizzo industriale del CO₂)	Il modulo riguarda le altre tecnologie che sono legate allo stoccaggio geologico della CO ₂ , ovvero il trasporto e la cattura. Verranno illustrati i differenti processi industriali di cattura, valutandone vantaggi e svantaggi, nonché il miglior campo di applicazione (cementi, idrocarburi, ecc.). Verranno illustrati alcune esempi di processi attualmente in uso nell’industria.	Prof. A. Pettinau (Sotacarbo, Progetto Enos)	ING-IND 24, 25	3	75	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto



<p>Module 3 - Introduction to exploration geophysics (Introduzione alla esplorazione geofisica)</p>	<p>Il modulo introduce le basi della interpretazione sismica, con particolare riguardo alla caratterizzazione del sito e alla valutazione del potenziale del sito. Il modulo presenta i principali aspetti della acquisizione, elaborazione e interpretazione del dato sismico al fine della ricostruzione del modello geologico statico in 2 e in 3D.</p>	<p>Prof. S. Bigi Prof. M. Battaglia</p>	<p>GEO/03 GEO/11</p>	<p>3</p>	<p>75</p>	<p>Lezioni frontali, esercitazioni, studio individuale</p>	<p>Vedi sotto</p>
<p>Module 4 - CO₂ geological storage options - geology and geochemistry (Tipologie di stoccaggio geologico – geologia e geochimica)</p>	<p>Il modulo fornisce una panoramica dei tipi di reservoir da un punto di vista geochimico - mineralogico, delle relative modalità di intrappolamento e del potenziale volume utilizzabile. Verranno discusse le proprietà fisiche della CO₂ in condizioni di stoccaggio (supercritiche) che influenzano lo stoccaggio stesso, e saranno descritti i processi geochimici che influenzano il comportamento della CO₂ a lungo termine nel reservoir stesso.</p>	<p>Docente da definire Prof. Paolo Ballirano</p>	<p>Geo/03 Geo/06 Geo/08</p>	<p>3</p>	<p>75</p>	<p>Lezioni frontali, esercitazioni, studio individuale</p>	<p>Vedi sotto</p>
<p>Esami orali (presentazione dei risultati delle esercitazioni pratiche). Trasferimento all'Università di Zagabria.</p>							
<p>Module 5 - Introduction to reservoir engineering (Introduzione all'ingegneria di reservoir)</p>	<p>Il modulo fornirà agli studenti le conoscenze di base dei meccanismi di flusso multifase e dei parametri che possono aiutare nella caratterizzazione del flusso nelle rocce porose. Verranno illustrati i principi fondamentali della descrizione dei fluidi PVT (salamoia, gas, olio),</p>	<p>Prof. D. Vulin Prof. Iva K. Močilac (Zagheb University)</p>	<p>Geo/03 ING-IND 30</p>	<p>3</p>	<p>75</p>	<p>Lezioni frontali, esercitazioni, studio individuale</p>	<p>Vedi sotto</p>



	con particolare attenzione al comportamento di fase relativo a sistemi con un elevato contenuto di CO ₂ . Saranno presi in considerazione i calcoli relativi all'iniezione (sia miscibili che immiscibili) e ai principi fondamentali della sorveglianza dei dati sui giacimenti.						
Module 6 - Storage site selection and capacity estimates (Selezione del sito di stoccaggio e stima della capacità)	Il modulo illustra i differenti approcci nella stima del potenziale di stoccaggio di CO ₂ durante la valutazione del bacino e della capacità di stoccaggio di CO ₂ di un sito sulla base dello screening del sito e della caratterizzazione. Il corso si concentra sulla spiegazione dei diversi problemi che sorgono quando si valuta il potenziale di stoccaggio di CO ₂ o capacità di stoccaggio di diversi tipi di reservoir (acquiferi salini profondi, giacimenti di idrocarburi esauriti, giacimenti di carbone, caverne di sale). Inoltre, vengono descritte le procedure di caratterizzazione dettagliata delle rocce del serbatoio e delle rocce di copertura.	Bruno Saftic (Zagheb University)	Geo/03	3	75.	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto
Module 7 - Numerical modelling of CO₂ storage (Modellazione numerica dello stoccaggio di CO₂)	Questo modulo introduce gli studenti alla modellazione numerica, tra cui una descrizione di come sono costruiti i modelli seguito da un focus sulla simulazione del flusso. Il corso rafforza la teoria appresa nel modulo di ingegneria del reservoir (5), che è essenziale per garantire che gli studenti possano imparare come impostare le simulazioni e come interpretare i	Gillian Pickup (Heriot Watt University Edinburgh, Scotland) (Progetto Enos)	Geo/03 ING-IND 30	3	75	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto



	risultati. Viene presentata la teoria di base della simulazione del flusso, seguita da una serie di sfide (come l'upscaling e il trattamento dell'incertezza nelle proprietà del giacimento). Infine, viene presentata una revisione di processi più avanzati, come la modellazione accoppiata.						
Module 8 - EOR with CO₂	Il modulo fornirà agli studenti approfondimenti sui meccanismi e sui metodi di valutazione per Enhanced Oil Recovery (EOR) e per migliorare i processi relativi allo sfruttamento delle risorse sotterranee in generale. L'accento sarà posto sui processi che coinvolgono l'iniezione di CO ₂ o la riduzione delle emissioni di CO ₂ .	Prof. D. Vulin Prof. I.K. Močilac (Zagheb University)	Geo/03 – ING-IND 30	3	75	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto
Esami: elaborazione di una relazione scritta da consegnare alla fine del Modulo 6; presentazioni orali per i moduli 5 e 8; esame scritto per il modulo 7.							
Module 9 - Storage Risks	Il modulo introdurrà la valutazione del rischio per lo stoccaggio geologico di CO ₂ per prevenirne qualsiasi perdita. Il corso si concentra sulla valutazione del rischio; questo è un processo iterativo che deve essere fatto in ogni fase di un progetto di stoccaggio, dalla selezione, caratterizzazione e studio di riferimento fino alle fasi di chiusura del sito, post chiusura e trasferimento definitivo di responsabilità da operatore allo Stato. Questa valutazione è la base per la progettazione di un buon piano di monitoraggio e un piano efficace per la	Niels Poulsen GEUS, Geological Survey of Denmark and Greenland (Progetto Enos)	Geo/03	2	50	Lezioni frontali, esercitazioni, studio individuale	Vedi sotto



	prevenzione e la correzione in caso di perdita. La valutazione dei rischi e il piano di monitoraggio sono aggiornati quando necessario, in particolare in caso di comportamento anomalo o nelle fasi di chiusura e post chiusura. L'attenzione sarà anche sull'obbligo di valutare i rischi e i sistemi di mitigazione associati alla tecnologia CCS.						
Esame scritto e trasferimento a Roma.							
Module 10 - Geophysical monitoring (Monitoraggio geofisico)	Il modulo introduce i principi fisici delle tecniche geofisiche applicate allo stoccaggio di CO ₂ . Il corso si concentra sulla spiegazione dei metodi geoelettrico, elettromagnetico e sismico applicati alla valutazione del potenziale delle formazioni geologiche per lo stoccaggio di CO ₂ , e per monitorare il processo di stoccaggio di CO ₂ .	Prof. M. Cercato	Geo/11	5	125	Lezioni frontali, Escursioni e studio individuale	Vedi sotto
Module 11 - Geochemical monitoring	Questo modulo introdurrà una vasta gamma di tecniche di monitoraggio geochimico a scala regionale e locale, utilizzate per monitorare i siti CCS per garantire l'audit dei "carbon credits", per trovare e quantificare le potenziali perdite e per determinare l'efficacia di qualsiasi azione di bonifica intrapresa. Le lezioni descriveranno il background tecnico e il funzionamento di ciascun metodo, i loro vantaggi e svantaggi in termini di sensibilità, scala e risoluzione e costi. Gli esercizi sul campo alla fine di questo modulo daranno agli studenti un'esperienza pratica con un sottoinsieme dei metodi descritti.	Docente da definire	Geo/08	3	75	Lezioni frontali, Escursioni e studio individuale	Vedi sotto



Module 12 - Drilling and wells (Perforazioni e pozzi)	Il modulo è un corso introduttivo alla perforazione e ai pozzi. Gli argomenti trattati includeranno attrezzature di perforazione, controllo dei pozzi, collaudo, completamento e miglioramento della permeabilità. Il modulo comprenderà materiale descrittivo e richiederà anche abilità pratiche nella conduzione di semplici calcoli di progettazione.	Prof. Sean Rigby University of Nottingham (Progetto Enos)	ING-IND 30	2	50	Lezioni, esercitazioni e studio individuale	Vedi sotto
Module 13 - Economic and Regulatory aspects of CCS technology	Il corso fornisce una panoramica delle basi degli aspetti normativi, economici e sociali della tecnologia di cattura e stoccaggio del carbonio (CCS). Il CCS è considerato uno strumento importante nella riduzione delle emissioni globali di anidride carbonica, quindi in grado di ridurre l'impatto del genere umano sui cambiamenti climatici. I singoli progetti CCS di successo derivano da condizioni geologiche adeguate, da un quadro normativo favorevole che contribuisce alla loro redditività economica e al sostegno pubblico sia a livello nazionale che locale.	Prof. Alla Shogenova Tallinn University, Estonia (Progetto Enos)	ING-IND 35	1	25	Lezioni, esercitazioni e studio individuale	Vedi sotto
Module 14 - CCUS and cross-cutting issues	Il modulo introdurrà diverse opzioni di utilizzo della CO ₂ catturata, compresa una breve panoramica di tutte le possibili opzioni di utilizzo della CO ₂ , compreso l'uso di CO ₂ per il recupero potenziato delle risorse (energia geotermica, recupero di metano da strati di carbone, "shale gas", acqua) e utilizzo di CO ₂ per la produzione di	Prof. Alla Shogenova, Tallinn University, Estonia (Progetto Enos)	Geo/03 Geo/08	3	75	Lezioni, esercitazioni e studio individuale	Vedi sotto



	idrocarburi. Verranno introdotti il concetto di Bio-CCS e le emissioni negative, comprese le emissioni di gas serra dirette e indirette, le tecnologie Bio-CCS, le loro sfide e vantaggi e l'attuazione di progetti Bio-CCS. Il modulo tratterà inoltre: la carbonatazione minerale di CO ₂ , la comparazione tra le tecnologie di stoccaggio geologico e di carbonatazione minerale, lo stoccaggio di CO ₂ nei basalti, la sinergia di CGS con il recupero di energia geotermica, stoccaggio di energia e recupero di acqua, vantaggi della sinergia tra CCS ed energie rinnovabili, ruolo delle industrie di cemento nella produzione di CO ₂ .					
Esami: scritto per il modulo 10 ed orale per tutti gli altri moduli.						
Tirocinio 1	<i>lavoro di gruppo (5 gruppi di 2 studenti) questa settimana sarà organizzata con un lavoro attivo degli studenti, che saranno divisi in gruppi e dovranno condurre una piccola ricerca in modo indipendente. Il database di partenza sarà lo stesso per tutti i gruppi. Il risultato sarà una interpretazione geologica e la valutazione del potenziale di stoccaggio dell'area in esame.</i>			5	125	<i>C/O strutture di Sapienza</i>
Prova finale	<i>Valutazione totale e assegnazione sede per il project work Gli studenti saranno valutati in base ai punteggi ottenuti durante il corso e saranno loro assegnate le sedi per lo svolgimento dello stage in funzione della valutazione, tenendo presente gli interessi degli stessi e delle attività offerte delle diverse sedi.</i>			15	375	<i>Project work, con relazione finale e presentazione da discutere davanti alla commissione/consiglio scientifico</i>



					<i>consistente nella presentazione e discussione dei risultati del lavoro svolto nel tirocinio</i>
TOTALE			60	1500	



Elenco Professori, breve CV

Prof. E. Carminati

Born in 1968, in 1993 I got a degree in Geological Sciences at the University of Milano with a thesis in Structural Geology. I achieved the PhD in 1997 with a thesis in Tectonophysics at the University of Milano. I worked as a post-doc from 1996 to 1998 at the department of Geophysics of the University of Utrecht (the Netherlands) in the framework of the EC project no. ERBCHRX CT94-0607 "Geodynamics of the Western Mediterranean Sea". I got a post-doctoral fellowship from 1998 to 2000 at the department of Earth Sciences of the University of Milano. From 2000 to 2012 I worked as University Researcher at the department of Earth Sciences of the University of Roma "La Sapienza", and as associate Professor from 2012 to 2016, and I'm currently full professor. I'm fellow of the Geological Society of Italy and of the American Geophysical union. Between 2004 and 2006 I've been member of the council of the Italian Geological Society. From 2007 to the beginning of 2013 I was member of the National University Council (CUN; www.cun.it). Since 2008 I'm editor of Pure and Applied Geophysics. Since 2015 I'm responsible for the organization of teaching of Earth Sciences at the Sapienza University.

Research topics I began my research activity as a field structural geologist working on the crystalline basement of the Central Southern Alps (Northern Italy). Being interested in quantitative aspects of geology, I did a PhD in Tectonophysics, studying the dynamics of convergence zones by means of finite elements model constrained, as far as possible, by geological and geophysical data. In particular I concentrated my research activities on the Central Southern Alps and on the Northern Apennines (Italy). Meanwhile I continued my field activities (structural mapping and strain analysis) in an area of the Briançonnais of the Western Alps, characterised by sedimentary covers plastically deformed by intense compressive tectonics. During a post-doc at the department of Geophysics of the University of Utrecht I enlarged my interests to the whole central and western Mediterranean area, studying its geodynamic evolution from the Tertiary to the Present and testing different geodynamic scenarios by means of numerical models. At the moment I'm interested in collecting, for different areas of Italy (Alps, Po Plain and Northern-Central Apennines), quantitative observables (e.g., vertical movements, stress and strain fields) and in their interpretation with respect to tectonics (kinematics and dynamics) and geodynamic processes active in these areas. Furthermore, I study the principal geodynamic processes (subduction and rifting) and their controlling forces at a global scale. I'm also interested in basin analysis with the application of the back stripping technique to evaluate the influence of tectonics and compaction on the geometries of syn-tectonic and post-tectonic sediments in extensional and compressional basins.

I'm finally interested in the mechanics of faults (at both crustal and subcrustal levels) incompressional, extensional and strike-slip settings (e.g., front of Alps, Apennines, internal zones of the Apennines, subduction zones, El Salvador, Ethiopian rift).

Prof. S Bigi

Education and qualifications - Born in 1964, in 1988 she got a degree in Geological Sciences at the University of Rome with a thesis in Structural Geology. She achieved the PhD in 1993 with a thesis in Geodynamics and Structural geology at the University of Camerino, where she worked as a post-doc from 1993 to 1994. Since 1996 she works as Researcher at the Department of Earth Sciences of the University of Roma "La Sapienza", where she currently teaching the course "Seismic interpretation and 3D modelling" and the course "Geological storage". In 2013 she became scientific responsible of the Fluid Chemical Lab (now Tectonics and Fluid Chemistry Lab) of the Earth Science Department. In 2013 she obtained the national scientific qualification as associate and as full professor in 2017 in the sector 04-A2 Structural geology, Stratigraphy, Sedimentology and Paleontology. In the last two years, she was deeply involved in activities of research coordination on geological storage of CO₂; she is member of the Executive Committee of CO₂Geonet (The European Network of Excellence on the Geological Storage of CO₂, <http://www.co2geonet.com/>) and of EERA (European Energy Research Alliance) as representative of



Sapienza University. She is team leader for the H2020 ENOS project (www.enos-project.com) and is coordinator of the LIFE Respire Project (www.liferespire.it).

Research topics – Her main research interest is focused on brittle deformation, and comprises the studies of faults and fractures network, with application in the field of hydrocarbons exploration and applied geology. Faults studies were dedicated to the reconstruction of fault architecture and evolution, with particular attention to gas bearing and active faults. Fractures network studies were focused on fractures characterization in carbonates and on development of new fracture models for fluid flow simulation. From 2006 she is member of the Chemical Fluid Lab, where she can study the control exerted by faults and fractures on fluid circulation, and the application on geological storage of CO₂. In the last two (2013-2015) years she worked on the geological and geochemical characterization for a demo site in the Sulcis basin (Sardinia), founded by Energy Ministry and Sardinia Region.

She dedicated more than a decade (1990 - 2005) to the study of the Apennines geological evolution and, more in general to thrust tectonics studies and the interplay between tectonics and sedimentation in contractional settings. In particular, she studied the influence of pre-existing structure on the geometries and kinematic of an evolving fold-and-thrust-belt, such as the Apennines, but she also worked on other thrust belt as the Zagros Mountains (Iran) and the Andes (Argentina). She has experiences in field map geology, having worked as field geologist for the Geological Survey of Italy, at the realization of the national geological maps (CARG Project), scale 1:50.000. She also improved geological mapping activities testing and applying GIS application.

Prof. Ettore Cardarelli

Graduated in Physics at the University of Rome "Sapienza", Full Professor at DICEA, Sapienza University. Scientific activity: He has been interested in both applicative and methodological studies of some methods of Applied Geophysics using Geoelectric, Seismic, Gravimetry, Magnetic and Integrated Method methods Inversion theory: In this context, it is interested in the problems concerning the various geophysical methodologies facing problems of stability, conditioning and poor position of inverse problems. Scientific responsible for numerous research projects promoted by the CNR and agreements with public and private bodies. He is a member of the scientific council of the Reatino Research Center for Engineering for the Protection and Enhancement of the Environment and Territory of "Sapienza" (CRITEVAT) Scientific management: With the University of Miskolc (Hungary) and the University of Mississippi (USA). International Activities He has been "Invited Lecture" at international and national conferences, chairman at the international journals Geophysical Prospecting and Near Surface Geophysics and Lecturer at the International Geophysics School at the Erice International Physics Center.

Prof. Paolo Ballirano

Paolo Ballirano, born in 1964 in Roma, has obtained a degree magna cum laude in Geological Sciences at Sapienza University of Roma in July 1990. In June 1991 was the winner of two competitions for a ministerial three years project (Ph.D. Grants "Earth Sciences" and Chemical Sciences") both at Sapienza University of Roma. He opted for the Ph.D. project "Earth Sciences" and obtained the PhD degree, in September 1994, successfully defending the thesis "Cristal-chemistry of cancrinite-group minerals". During the period September 1991-May 1992 was Visiting Scientist at the Depts. of Geology and Chemistry/Biochemistry, Arizona State University, USA. In May 1992 was the winner of a NATO Travel Grant for attending the International School of Crystallography: Modern Perspective in Inorganic Crystal Chemistry, Erice. In June 1994 received the S.I.M.P. prize (Società Italiana di Mineralogia e Petrologia) for the best Ph.D. thesis of mineralogical subject of the year. During the period November 1994-November 1996 obtained a Post Doc position at the Department of Earth Sciences of the University of Pisa. During the period December 1996-October 1998 obtained several short research contracts with the Department of Earth Sciences of Sapienza University of Roma. In May 1997 was elected (first Italian) Active Member of the International Centre for Diffraction Data (I.C.D.D.). In December 1997 was the winner of a Travel Grant of the European Mineralogical Union (EMU) for attending the Modul'97 school, Budapest, Hungary. In



September 1998 received the Ugo Panichi Prize from S.I.M.P. as the best Italian young researcher in the mineralogical field for the period 1996-1998. During the period October 1998-March 1999 was in charge of the X-ray diffraction labs of CTG S.p.A. Italcementi group, Bergamo. In May 1999 obtained the position of Researcher at the Department of Earth Sciences at Sapienza University of Roma. In July 2002 he obtained the suitability for the Associate Professor position at the national competition (GEO/06) at Palermo, III sessione 2001. In June 2003 was the winner of a NATO Travel Grant for attending the International School of Crystallography: High Pressure Crystallography, Erice. In September 2003 was included in the "Albo degli Esperti" (art. 7 comma 1 del Decreto Legislativo n. 297 del 27-7-1999) with MMIUR decree n. 1543 8-9-2003. In February 2004 was selected for the position of Associate Professor at the Department of Earth Sciences of Sapienza University of Roma. From 1-1-2005 is in service as Associate Professor at the Department of Earth Sciences of Sapienza University of Roma. The principal research area is the characterization by modern analytical methods (X-ray powder and single-crystal diffraction, TEM, IR and Raman spectroscopy, calorimetry) and calculations (ab-initio structure determination, molecular dynamics) of pseudozeolite minerals, fibres, nanomaterials, inorganic and organic materials, pigments, and cement phases. He is also involved in the development of new X-ray diffraction techniques and their application to the kinetics of phase transitions.

Prof. Maurizio Battaglia

Associate Professor, Department of Earth Sciences, Sapienza University of Rome, 2010-
Visiting Associate Professor, Department of Earth Sciences, Sapienza University of Rome, 2006-2010
Research Scientist, Dept of Structural Geology and Geodynamics, University of Göttingen, 2004-2006
Post-doctoral Scientist, University of California, Berkeley, 2002-2004
PhD in Geophysics, Stanford University, 1995-2002
Research Fellow, TecnoIdroMeteo SpA, Rome (Italy), 1992-1993
Experience Guest Scientist, Volcano Hazards Program, U.S. Geological Survey, Menlo Park (CA), 2006-
Guest Scientist, Earthquake Hazards Team, U.S. Geological Survey, Menlo Park (CA), 2004-2006

Research activity

- field work in volcano geodesy and volcano gravimetry (West Coast and Hawai'i, US)
- modeling of volcano unrest (Long Valley caldera, Kilauea, Mount St Helens, Campi Flegrei)
- field work and geodynamics of the Adria microplate (Friuli-Venezia Giulia)
- geological fluid mechanics (e.g., volcanic tremor, flow in fractured media)
- physical volcanology
- volcano collapse (Etna)

Prof. Michele Cercato

Michele Cercato received an MS Degree cum Laude (2000) in Environmental and Land Engineering and a PhD (2006) in Environmental Engineering from "Sapienza" University of Rome (2006). He was previously a Research Associate at "Sapienza" University of Rome from 2006 to 2010. He is currently a Researcher and Assistant Professor in Applied geophysics (SSD GEO/11), at the Dept. of Civil, Environmental and Building Engineering (DICEA) at "Sapienza" University of Rome. His main scientific interests are related to the application of integrated geophysical techniques to engineering problems, with particular regard to landslides, differential settlements and seismic site-effects evaluation (microzonation). Among these topics, particular relevant to his scientific activity are: Surface Wave Methods (SWM) and seismic ambient noise measurements, comparison between available and innovative geophysical techniques (both surface and borehole seismic methods) for in-situ shear-wave velocity and seismic attenuation evaluation, integrated geophysical methods for cavity location and geophysical inversion in general. He is member (since 2005) of EAGE (European Association of Geoscientists and Engineers), of the Italian Group of Solid Earth Geophysics (GNGTS) (since 2003) and of the EAGE-SEG Italian Section a member (since 2003). He has served as a reviewer for several international geophysical journals and he is currently Associate Editor for Near Surface Geophysics.



Prof. Bruno Saftic

Born in Zagreb 27.06.1964, in 1989 he graduated in Geology of Mineral Resources and Applied Geophysics at the University of Zagreb. Since 1989 he is affiliated with Faculty of Mining, Geology and Petroleum Engineering (UNIZG-RGNF). In 1993 he defended MSc Thesis “Depositional System of Sandstone Reservoirs of the Genetic Stratigraphic Sequence Poljana in the Neogene Sediments of the Zutica Field“ and in 1998 he defended PhD Thesis „Genetic Stratigraphic Sequence Analysis of the Pontian Sediments in the Western part of the Sava Basin“ (done at Faculty of Mining, Geology and Petroleum Engineering and in Croatian national oil co. INA Industrija nafte d.d., Naftaplín, Zagreb). Mentors: Prof. Dr. Josipa Velic and Dr. Jozef Simon.

In capacity of associate professor he teaches various courses in the fields of petroleum geology, coal geology, seismic stratigraphy, subsurface mapping etc. He mentored and co-mentored five PhD Theses altogether, two of them related to geological storage of CO₂. As a Croatian representative in ENeRG since 2000, he took part in three FP6 projects, all related to geological storage of carbon dioxide (CASTOR, EU GeoCapacity and CO₂NET EAST). Later, he was leader of the Croatian research team in two FP7 projects (ECCO and CGS Europe) and in the ongoing H2020 project ENOS. In the same period he lead the research projects in Croatia mapping the CO₂geological storage potential, once for the Energy Efficiency and Environmental Protection Fund and for the second time for the HEP d.o.o. (Croatian state-owned power utility). He is also active in CO₂GeoNet, where UNIZG-RGNF is a member representing Croatia and in EAGE, as well as in various Croatian professional organizations.

Prof. Niels Poulsen

Dr. Niels E. Poulsen is senior scientist at GEUS. He holds an MSc and a PhD degree in geology from the University of Copenhagen (1990). His background is stratigraphy, palaeogeography and palynology with emphasis on Jurassic stratigraphy in mid-northern Europe, Neogene Biostratigraphy in Denmark, the North Sea and northern Atlantic and Quaternary in Danish offshore area, Baltic Sea and North Atlantic. He is advising the Danish Energy Agency on regional hydrocarbon and geothermal exploration.

He became part of the CCS team at GEUS in 2008, and participated in the COACH Project as WP leader (WP3: Geological storage and large scale use of CO₂) and was project leader for the project: Mapping of the storage potential of CO₂ in the eastern North Sea, Skagerrak, Kattegat and onshore Denmark (2010–11). He recently joined the Executive Committee of CO₂GeoNet (The European Network of Excellence on the Geological Storage of CO₂).

At present he participates in the CGS Europe project (task leader of CGS Europe Spring School on CO₂ storage), the CO₂ReMoVe, BIGCCS and SiteChar projects. He is coordinator for the CO₂StoP project (2011–2013).

Prof. Domagoj Vulic

Associate Professor at Faculty of Mining, Geology and Petroleum Engineering (RGN), Petroleum Eng. Dpt. His research interest are: Enhanced coalbed methane production; Microstructural characterization of heterogeneous porous rocks; EOR; CO₂–oil relative permeability under miscible conditions; Dynamic optimization for the core-flooding problem in reservoir engineering.

In 2003, he graduated in Petroleum Engineering at the University of Zagreb and since then he is affiliated with Faculty of Mining, Geology and Petroleum Engineering (UNIZG-RGNF). In 2010 he defended PhD Thesis „Modelling Thermodynamic and Petrophysical Parameters for Geological Storage of Carbon Dioxide“ (at Faculty of Mining, Geology and Petroleum Engineering).

He teaches several BS, MS and PhD courses in the fields of petroleum reservoir engineering, related to PVT characterization, fluid and rock properties characterization, EOR, reservoir simulation etc. He supervised one PhD thesis. He took part in three FP6 projects, all related to geological storage of carbon dioxide (CASTOR, EU GeoCapacity and CO₂NET EAST), in two FP7 projects (ECCO and CGS Europe) and in the ongoing H2020 project ENOS. He was working on Energy Storage Mapping and Planning (H2020 ESTMAP project)



as subcontractor, and is the leader of ESCOM (Evaluation System for CO₂ Mitigation, funded by Croatian Science Foundation) project. He also participated TARGET project (co-financed by EU Erasmus+) related to establishment of higher education qualifications and occupational standards in mining, geology and chemical technology sector.

Prof. Sean Rigby

Sean Rigby is working as an Professor of Chemical Engineering, Faculty of Engineering in University Park Nottingham. His main research interest are:

Characterisation of porous media My work has focussed on employing a synergistic combination of different characterisation techniques in order to provide a more comprehensive description of porous media than is possible using one method alone. This is because each experimental technique has its own set of strengths and weaknesses. I have combined the traditional techniques of gas sorption and mercury porosimetry with tomographic methods such as MRI and MFX. Much of the work involves developing more sophisticated models for the interpretation of gas sorption and mercury porosimetry. A variety of different modelling methodologies have been adopted, which include employing concepts from fractal physics, for example.

Transport in porous media The structural architecture of porous media will significantly influence the rates of the various transport processes that occur within them. This work involves the construction of models for the transport processes and porous structures, and the subsequent validation of the model predictions against experimental data. The experimental techniques that I employ for studying transport include MRI, Pulsed-field Gradient Spin-Echo NMR and deuterium NMR. A greater understanding of the transport processes and the factors that influence their rates will allow us to design more effective catalysts that are more resistant to deactivation, or improve the recovery efficiency of oil, for example.

Enhanced Oil Recovery (EOR) My interests in EOR include the development of experimental techniques and theoretical analysis methods for structural characterisation of oil reservoir rock cores, using methods such as magnetic resonance imaging (MRI), pulsed-field gradient (PFG) NMR, mercury porosimetry, gas sorption and microscopy. I am also interested in transport phenomena in reservoir rocks. The particular processes that I study are gas and/or liquid phase permeation and adsorption, and the entrapment of non-wetting phases (such as oil) within porous solids. These studies are both theoretical (eg molecular dynamics simulations of flows of non-wetting fluids) and experimental (eg gas permeation, and mercury intrusion and extrusion). The purpose of these studies is to predict key characteristic parameters for reservoir rocks, such as the bound volume index (BVI), that are used in reservoir economic evaluation and reservoir simulations. I also work on reservoir simulations of various EOR methods, such as THAI and CAPRI.

Prof. Gillian Pickup

For many years, G. Pickup was involved in a project to study the effect of reservoir heterogeneity on hydrocarbon recovery. In particular, she focussed on upscaling the effects of small-scale structures for use in larger scale models. From 2005-2008, she was a member of the Uncertainty Quantification Group and studied model complexity and error modelling. Over the past few years, she has applied the knowledge gained in oil-related projects to investigate CO₂ storage in saline aquifers. G. Pickup has played a key role in the CASSEM and ETI UKSAP projects. In 2009 G. Pickup was awarded the SPE Aberdeen Award for Contribution to industry.

Roles and responsibilities: Lecturer in Reservoir Simulation; Deputy Director of PE masters programme; Co-I on several CO₂ Storage Projects; Member of Technical Committee for the European Conference on the Mathematics of Oil Recovery.

Research Main research fields include: Reservoir heterogeneity and modelling, Reservoir simulation, Simulation of CO₂ Storage.

Biography

2010: Promoted to Lecturer, Heriot-Watt University. Currently researching into numerical simulation of CO₂ storage.

1998: Promoted to Research Fellow, Heriot-Watt University.



1996: Promoted to Senior Research Associate, Heriot-Watt University.

1990: Research Associate, Department of Petroleum Engineering, Heriot-Watt University. Working on a joint industry project on reservoir heterogeneity (which ran from 1990 – 2002).

1981-1989: Various part-time positions, including part-time Research Fellow at University of Edinburgh, Open University Tutor and high-school teacher in Hawaii.

1977-1980: Scientific Officer in Institute of Geological Sciences (now BGS), geophysical support programmer.

1979: PhD in Astrophysics, University of Edinburgh.

1974: BSc(Hons) Astrophysics, University of Edinburgh.

Prof. Alla Shogenova

Alla Shogenova is a Ph.D. in Geology and Mineralogy from St. Petersburg Mining Institute, Russia, 1992 and M.S. in Geophysics from Leningrad Mining Institute, 1981.

Dr. Alla Shogenova has a multidisciplinary experience in the field of CO₂ geological storage, geology and geophysics and long-term experience in leading of international projects. She is a senior researcher in the Institute of Geology at Tallinn University of Technology, where she is working since 1989. In 2013 she was a Visiting Professor in CO₂ Geological Storage at Faculty of Geology, University of Warsaw supported by EU Project Modern University. Beginning from 1994 she is a leader of a number of national and international research projects. A. Shogenova is an author and co-author of about 165 scientific publications including 30 publications and 12 reports in the field of CCS. She was a leader of Estonian research group in the projects FP6 EU GeoCapacity and CO₂NetEast, FP7 CGS Europe and CO₂Stop. In 2005-2009 she was a member of the Taskforce Technology in ZEP, member of Scientific Advisory Board of CO₂GeoNet, member of CO₂NET. She is an adviser in CCS for national legal authorities and energy companies in Estonia and Baltic Region since 2008 and active member of the BASREC CCS Network. Dr. Shogenova was a president of the ENeRG network in 2007, editor of the ENeRG website in 2008-2011 and of the GEO ENeRGY newsletter since 2012. She is a university lecturer and supervisor of Ph.D. and M.S. students in the field of CCS, petrophysics and geophysics. Dr. Shogenova participated in the DG CLIMA contract "Implementation of Directive 2009/31/EC on the geological storage of carbon dioxide (CCS Directive) - support to the implementation report". on behalf of the CO₂GeoNet.

She participates now in the Seed Money project CO₂ Geological Storage in the Baltic Sea Region (CGS Baltic, 7 partners) supported by EUSBSR and in Horizon 2020 project ENabling Onshore CO₂ Storage in Europe (ENOS, 2016-2020).

Prof. Iva Kolenković Močilac

She graduated in 2006 in Hydrogeology at the University of Zagreb and in the same year she has been employed as a teaching and research assistant on the Faculty of Mining, Geology and Petroleum Engineering (UNIZG-RGNF). In 2012 she defended PhD Thesis focused on regional capacity estimates for CO₂ geological storage. In 2016 she became an assistant professor and since then she teaches courses mainly focused on petroleum geology, coal geology and subsurface mapping. She was engaged on several projects focused on geological storage of carbon dioxide (FP6 projects EU Geocapacity and CO₂NetEast, FP7 projects ECCO and CGS Europe). Currently, she is involved in H2020 project ENOS.